APPLICATION OF UNSATURATED SHEAR STRENGTH PROPERTIES IN SLOPE STABILITY ANALYSIS

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DECLARATION

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

Signature of the Candidate

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ABSTRACT

Unsaturated soil mechanics is becoming increasingly popular in the world of Geotechnical Engineering due to the additional shear strength that unsaturated soils possess compared to saturated soils and specific problems that are associated with unsaturated soils. In this thesis, unsaturated shear strength properties of a selected residual soil are derived and their effects on the stability of slopes are investigated.

The shear strength function and the Soil Water Characteristic Curve (SWCC) of the soil found at Pussallawa landslide are developed through a laboratory testing programme. Thereafter, the Pussallawa landslide is analysed under saturated and unsaturated conditions depending on the location of the water table, using shear strength parameters obtained from the laboratory testing programme. In addition, the Kahagalla landslide and a hypothetical cut slope are analysed similarly assuming different locations of water table. An EXCEL spreadsheet is developed to analyse stability of slopes using saturated and unsaturated shear strength of soils.

Results obtained for the hypothetical cut slope by the spreadsheet application developed here are compared with those given by the SLOPE/W software, using different methods available to analyse stability of slopes. This yields a comparison among the different methods of slope stability analysis. Results are presented in graphical and tabular form.

As it is difficult to measure insitu suction values in local slopes at present, the parametric study done here gives an insight into the problem of landslides. This method can be refined to find a reliable factor of safety for slopes once methods are developed locally for insitu measurement of suction.

The analysis shows that there is a significant improvement in the factor of safety when the slopes are unsaturated, compared to that when they are saturated and the factor of safety under unsaturated conditions increases as the depth to water table from the failure surface increases. It also shows how slopes can fail upon saturation.

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